CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. A process for rapidly heating a fuel processor to its operating temperature, the process comprising:

a) reforming fuel with a catalyst to produce steam, carbon monoxide, and hydrogen gas;
b) homogeneously mixing air with the carbon monoxide and hydrogen gas to create a mixture which will react and produce heat;
c) using the heat to raise the temperature of catalysts in the fuel processor;
d) combining the mixture with an oxidant to decrease the concentration of carbon monoxide;
e) using the heat to produce steam; and
f) mixing the steam with the mixture to increase the yield of hydrogen gas.

2. The process as recited in claim 1 wherein a front edge of the reforming catalyst is heated to a temperature at which a fuel-air mixture ignites and generates heat which can be used for vaporization of subsequent fuel.

3. The process as recited in claim 1 wherein the catalyst causes catalytic partial oxidation (CPOX).

4. The process as recited in claim 3 wherein the partial oxidation is of hydrocarbons with oxygen (O_2) to produce carbon monoxide (CO), hydrogen (H_2), carbon dioxide (CO_2), and water (H_2O).

5. The process as recited in claim 1 wherein the mixture is subjected to catalyst at a temperature of from about 25°C to 500°C.

6. The process as recited in claim 1 wherein the oxidizing agent facilitates the oxidation of hydrogen and carbon monoxide.

7. The process as recited in claim 1 wherein the air-carbon monoxide-hydrogen gas mixture contains an oxygen/carbon ratio of more than one and less than 2.

8. The process as recited in claim 1 wherein the fuel can be liquid, vapor, or a combination thereof.

9. The process as recited in claim 5 wherein the temperature is reached within 30 seconds.

10. The process as recited in claim 1 wherein the air-to-fuel and steam-to-fuel ratios are adjusted to have temperatures in the reforming fuel catalyst from between about 600°C to 850°C.

11. The process as recited in claim 1 wherein the maximum temperature in the reforming fuel catalyst is about 900°C.

12. A method for converting hydrocarbon fuels to a reformate gas, the method comprising:

a) producing combustible moieties from the fuels;

b) oxidizing the combustible moieties to generate heat;

c) utilizing the heat to increase the surface temperatures of catalysts; and

d) contacting the reactants to the catalysts.

13. The method as recited in claim 12 wherein the step of producing combustible moieties further comprises combining the fuel with an oxidant to create a mixture.

14. The method as recited in claim 13 wherein the oxygen/carbon ratio of the mixture is more than one and less than 2.

15. The method as recited in claim 12 wherein the combustible moieties are carbon monoxide and hydrogen.

16. The method as recited in claim 12 wherein the step of contacting the fuel to the catalyst results in the formation of carbon monoxide and hydrogen gas.

17. The method as recited in claim 15 wherein a portion of the carbon monoxide and hydrogen is reacted with oxygen to create heat.

18. The method as recited in claim 17 wherein the heat raises the temperature of a water-gas shift catalyst so the catalyst becomes active for its water-gas shift reaction which converts carbon monoxide and generates additional heat.

19. The method as recited in claim 12 wherein air is injected downstream of the catalysts to have complete oxidation of all combustible moieties before the combustible moieties have egress from the system.

20. The method as recited in claim 12 wherein liquid water is injected when the water-gas shift catalyst temperature exceeds 400^{0}C.

21. The method as recited in claim 19 wherein the liquid water is injected in the form of water droplets having diameters less than 50 microns (μ).

22. A device for the vaporization of fuel, the device comprising:

a) a means to provide the latent heat of vaporization of the fuel; and

b) a means to provide superheating of the fuel.

23. The device as recited in claim 22 wherein the means to provide the latent heat of vaporization of the fuel is a first heating element.

24. The device as recited in claim 22 wherein the means to provide superheating of the fuel is a second heating element.